



U.S. Department of Energy  
Energy Efficiency and Renewable Energy

*industrial technologies program*

# DOE BestPractices Plant-wide Assessments

**Mitchell Olszewski**  
**Oak Ridge National Laboratory**  
**Texas Technology Showcase**  
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**Houston, TX**



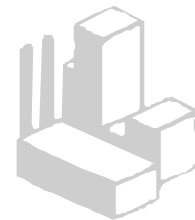
# What is a Plant-wide Assessment (PWA)?

- Applies a systems approach across entire plant operation
- Identifies energy and non-energy applications/opportunities that offer greatest energy benefits (blueprint for savings)
  - New/emerging process technologies
  - Best practices associated with plant support systems
- Provides a roadmap for improving energy efficiency, increasing productivity, and decreasing emissions

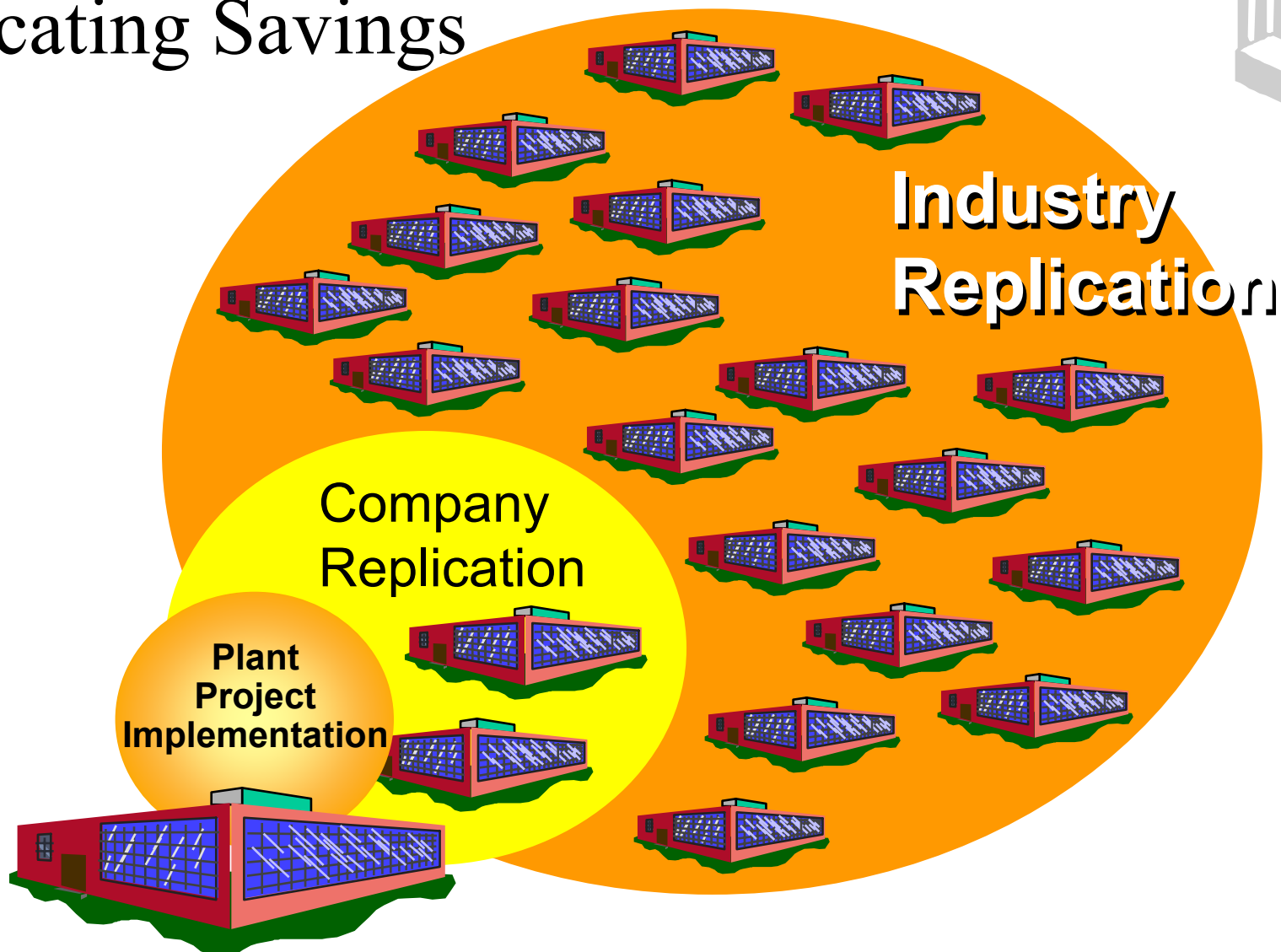


# DOE Goals for Plant-wide Assessment

- DOE promotes plant wide assessments to increase U.S. industrial energy efficiency, productivity, global competitiveness, and reduced emissions
- Build portfolio of industry area/assessment technique experience for dissemination
- Jump start industrial efforts
- DOE replication plans developed to promote dissemination within industrial sector and across sectors
- Follow up to determine implementation experience and replication efforts

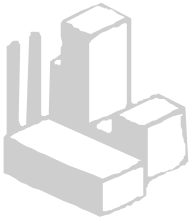


# Replicating Savings



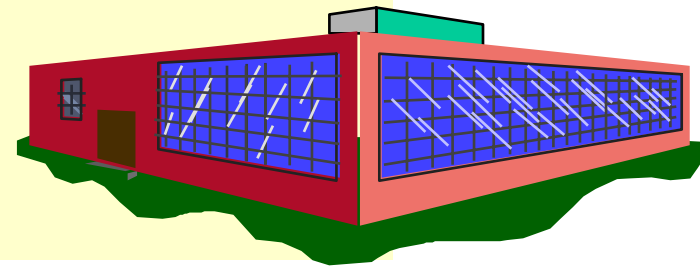


# Partnership with Industry



## **Plant-wide assessments for manufacturers are available on a cost-shared basis**

- Up to \$100 K in DOE funds competitively awarded to large plants through an open solicitation process
- Also available to Showcase plants
- Assessment team assembled by plant
- Summary case studies published to promote replications of recommended energy efficiency strategy





# Paramount Petroleum, Paramount CA



## Potential Benefits to Plant

- Estimated energy savings of 1,200,000 kWh of electricity
- Estimated savings of \$4.1M from energy reduction and other improvements
- 2.5 yr average payback period

## Identified Opportunities Include

- Combined heat and power (CHP)
- Gas-fired process heaters
- Variable speed drives for cooling tower fan motors

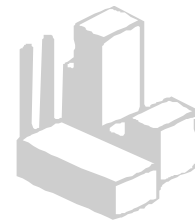


## Project Partners

- Paramount Petroleum Corporation, Paramount, CA
- Dana Technologies, San Juan Capistrano, CA
- Energy Nexus Group, Carlsbad, CA



# Akzo Nobel, Morris IL



## Potential Benefits to Plant

- Reduces electricity use by 35,900,000 kWh and steam use by  $70,000 \times 10^6$  Btu
- Saves an estimated \$1.2M in operating and energy costs
- 4.5 year average payback period

## Identified Opportunities Include

- Cogeneration of steam and electricity
- Process improvement in nitrile unit
- Heat recovery from fatty acid distillation
- Install steam system instrumentation to reduce steam waste

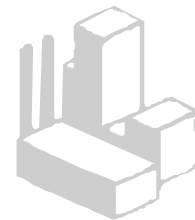


## Project Partners

- Akzo Nobel Surface Chemistry LLC  
Morris Plant, Morris, IL
- Akzo Nobel Energy BV  
Amersfoort, The Netherlands



# Bayer, New Martinsville WV



## Potential Benefits to Plant

- Estimated savings of \$1.4M from energy efficiency improvements
- Reduced use of fossil fuel by  $236,000 \times 10^6$  Btu
- Estimated energy savings of 6,300,000 kWh in electricity
- <1 year average payback period

## Identified Opportunities Include

- Burner replacement with an efficient, low-NOx design
- Expanded condensate return
- Installation of variable speed drives (VSDs) on cooling tower pumps
- Compressed air system optimization
- Four energy-saving projects costing \$10K or less



## Project Partners

- Bayer, New Martinsville, WV
- Colt Atlantic Div. of Colt Services, Burford, GA
- West Virginia University, Morgantown, WV



# Martinez Refinery, Martinez CA



## Potential Benefits to Plant

- Saves more than  $6,000,000 \times 10^6$  Btu and \$52M
- <1 year average payback period

## Identified Opportunities Include

- Improve the efficiency of fired equipment
- Utility system optimization
- Insulation repairs and heat exchanger cleaning
- Eliminate waste
- Other process changes (add hardware or controls to improve process results)

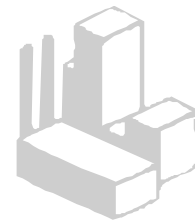


## Project Partners

- Martinez Refinery, Martinez, CA
- Shell Global Solutions, Houston, TX



# Neville Chemical, Anaheim CA



## Potential Benefits to Plant

- Saves an estimated 436,200 kWh of electricity
- Saves an estimated \$75,460 from energy reduction
- Replication at Pittsburgh plant identified \$717K in savings
- 1.2 year average payback period

## Identified Opportunities Include

- Use hot oil for heating Accumulator 3
- Combine the two thermal oxidizers into one
- Install a VFD on the heat transfer oil pumps
- Install a VFD on the cooling water pump
- Control the cooling tower fan with a VFD



## Project Partners

- BASE Energy Inc.,  
San Francisco, CA
- Neville Chemical Co.,  
Anaheim, CA



# Rohm and Haas, Knoxville TN



## Potential Benefits to Plant

- Energy savings of  $47,000 \times 10^6$  Btu steam and fuel and 11,000 MWh electricity
- cost savings of \$1.5M at Knoxville plant
- 2.7 year average payback
- Replication at two other plants identified energy savings of  $23,000 \times 10^6$  Btu and 6,000 MWh with cost savings of \$500,000

## Identified Opportunities Include

- Replace existing plant powerhouse with new firetube boilers
- Steam system maintenance
- Direct contact low-level heat recovery
- Install a hydraulic cleaning system to replace a steam system
- Optimize refrigerated water flow and temperature
- Substitute cooling tower water for refrigerated water in winter
- Cooling tower and compressed air system optimization

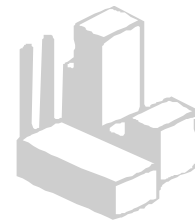


## Project Partners

- Rohm & Haas, Knoxville, TN
- Veritech, Sterling, VA
- Ameresco Inc., Charlotte, NC



# 3M, Hutchinson MN



## Potential Benefits to Plant

- Estimated energy savings of almost 6,000,000 kWh electricity and over 200,000 x 10<sup>6</sup> Btu natural gas and fuel oil
- Estimated first year avoided energy costs of more than \$1M
- 1.9 year average payback period

## Identified Opportunities Include

- Interconnect individual chilled water distribution systems
- Use chilled water system cooling towers as primary cooling method for the air compressors
- Thermal oxidizer heat recovery boiler
- Cogeneration – Steam turbine
- Lower relative humidity in the plant (reduce steam production)

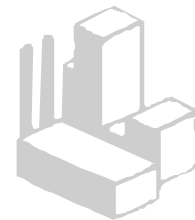


## Project Partners

- 3M, Hutchinson, MN
- Sebesta Blomberg & Associates, Roseville, MN



# W.R. Grace, Baltimore MD



## Potential Benefits to Plant

- Almost  $77,000 \times 10^6$  Btu steam savings;  
over 4,800,000 kWh electricity savings
- \$840,000 cost savings  
2.2 year average payback
- A separate landfill gas recovery project  
could save an additional \$900,000 -  
\$1,200,000 and almost  $560,00 \times 10^6$  Btu

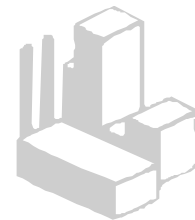
## Identified Opportunities Include

- Wastewater heat recovery
- Waste gas heat recovery
- Flue gas heat recovery
- Compressed air distribution  
system upgrade



## Project Partners

- W.R. Grace & Company, Columbia, MD
- Constellation Energy Source, Baltimore, MD
- Javan & Walters, Inc., Fort Washington, PA
- Goodrich Air Science Engineering,  
Chandler, AZ



# Flying J Refinery, North Salt Lake UT

## Potential Benefits to Plant

- 30 projects identified
- Potential cost savings of \$1.2M and energy savings of 298,400 x 10<sup>6</sup> Btu and 737,000 kWh
- 1.6 year average payback period

## Identified Opportunities Include

- Optimize crude distillation unit (CDU) pre-flash operation
- Put steam to bottom of CDU column on ratio control with atmospheric residual rundown flow
- Bypass heavy diesel rundown coolers on CDU
- Produce nitrogen on-site
- Improve piping insulation near naphtha hydrotreater reactor
- Reduce reformer circuit pressure drop
- Reduce water to sulfur recovery unit
- Check plant for leaking relief valves



## Project Partners

- **Flying J Refinery,**  
**North Salt Lake, UT**
- **UOP, LLC, Des Plaines, IL**



# Plant-wide Assessments: Examples

## Annual Savings Opportunities Identified

Anchor Glass	\$1,638,000.	MetLab	\$518,000.
Utica Corporation	\$1,880,000.	Bayer	\$1,478,000.
Equilon Enterprises	\$52,500,000.	Weyerhaeuser	\$3,100,000.
Neville Chemical	\$75,000.	Corning	\$25,920,000.
Appleton Paper	\$3,459,000.	Rohm & Haas	\$1,090,000.
Georgia Pacific - AR	\$5,000,000.	3M	\$1,094,000.
Alcoa – Bauxite, AR	\$1,072,000.	WR Grace	\$840,000.
Boise Cascade	\$707,000.	Ford	\$3,280,000.
Caraustar	\$1,280,000.	Inland	\$9,500,000.
Akzo Nobel	\$1,170,000.	Alcoa - IN	\$1,974,000.
		AMCAST	\$3,600,000.



# Additional Information

**Additional information on BestPractices activities and detailed Case Studies for each PWA are available on OIT's web site:**

[www.oit.doe.gov](http://www.oit.doe.gov)